Proposed Amendment between California Energy Commission and The Regents of the University of California, - CIEE

Title: Fault Analysis in Underground Cables
Amount: $440,966.00
Term: No term change
Performing Inst: The Regents of the University of California, Berkeley
Contact: Jamie Patterson
Committee Meeting: 9/1/2010

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
05	Electric	ETSI	Transmission Research Program (TRP)	$173,992	$173,992	$0	0%
06	Electric	ETSI	Transmission Research Program (TRP)	$1,758,200	$266,974	$430,000	24%

Recommendation

Approve this amendment for the agreement with The Regents of the University of California, - CIEE for $440,966.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

California has over 60,000 miles of underground cable installed in its distribution infrastructure. Various types of cable and methods of installation have been used over the past 50 years. Identifying failures, replacing, or repairing underground cables is a painstaking occurrence that involves restoring service for customers experiencing outages, environmental sensitivity, and performing maintenance without damaging the cable or risking customer outages. Presently, there are no industry accepted methods of diagnosis for detection of cable failure or occurrences linked to failures. Further, the industry accepted tests that identify these failure causing characteristics must be performed on cable out of service. There is a dire need for new diagnostic methods and techniques to detect these failures in-situ as the overall failure rate, condition, and age of the existing underground cable infrastructure continues to increase sharply.

Background

The aging of installed underground distribution cables is a looming issue facing electric utilities in California and throughout the U.S. A variety of technologies and tests are currently available to evaluate underground cables, but there is often little correlation between the diagnostic results and the actual deterioration. California utilities agree that new online approaches to detect change, predict failure, and establish remaining useful life of installed underground cable is needed to assure these assets are managed efficiently. This project will evaluate existing diagnostic approaches used to detect or predict incipient failure and determine if new innovative technologies can be utilized to improve diagnostic accuracy and reduce cost.

Public Interest Energy Research (PIER) program staff utilized an extensive literature search to determine the leading research institutions and researchers worldwide that were working to develop novel electrical and ultrasonic measurements to identify at-risk cables. The National Electric Energy Testing Research and Applications Center (NEETRAC) at Georgia Institute of Technology was identified as a national leader in the area and PIER was directed to "Cable System Diagnostic Technologies and Application Overview," an up-to-date summary of the state of the art in this field. After review of this document and discussions with leading researchers at NEETRAC, the University of Connecticut, and the National Science Foundation, PIER determined that a multi-disciplinary team of professors at the University of California, Berkeley would be strong candidates to develop new and novel approaches to evaluate underground cables. A scoping study was completed, and after review and discussion with California Investor-owned utilities, Department of Energy staff, and NEETRAC researchers, it was decided to develop a project with this team.

Proposed Work

This amendment will continue this research into stage 5 of the California Energy Commission (Energy Commission's) stages and gates research process by conducting research and technical diagnosis including:

- Evaluating candidate Underground (U/G) cable sensing techniques. The goal of this task is to: evaluate the practicality of the previously developed candidate sensing technologies for in-field on-line detection of failures in underground distribution cables.
- Working with the utilities (the end user) to develop an evaluation matrix describing the criteria of practicality for the proposed sensing technologies. These parameters may include factors such as sensitivity, distance to failure, robustness for in-field use, etc.
- Evaluating the performance for the candidate sensor technologies based on the evaluation matrix, and determine the preferred sensing techniques for future development.
- Conduct a semi-annual Technical Advisory Committee meeting.
- Developing initial prototypes of the preferred U/G sensing technique(s) for on-line in-field testing.
- Developing initial prototypes of the sensor packages for on-line testing of underground power distribution cables.
- Deploying the above sensor packages in an in-lab setting while detecting simulated (induced) cable failures.
- Collaborating with the local utility to develop a realistic test-bed for initial prototypes of the preferred sensing techniques.
- Performing a pilot study (using the test-bed) of the preferred U/G cable sensing techniques.
- Conducting the annual cables workshop to discuss the latest findings and review technologies.

An interdisciplinary research team is organized to evaluate the problem and attempt to identify, isolate and bench test various underground cable failure mechanisms and diagnostic techniques. Pacific Gas & Electric, Southern California Edison and San Diego Gas & Electric utilities provide support and assist with this project by sharing technical expertise and experience with the research team.

Justification and Goals

This project "[has] the potential to enhance transmission and distribution capabilities" (Public Resources Code 25620.1.(c)(3)).

This will be accomplished by:

- Promoting adequate investment in the utility distribution system using condition based monitoring, with an emphasis on translating those expenditures into higher levels of reliability per the Energy Action Plan 2005.